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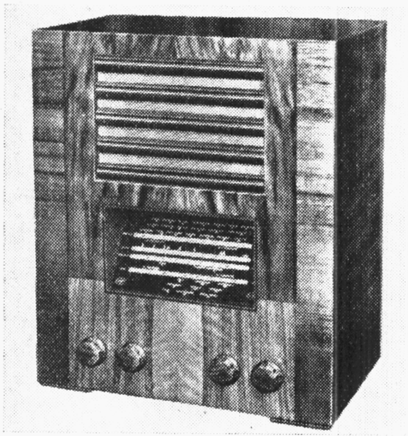
"TRADER" SERVICE SHEET

485

INVICTA A40

A40C AND A40RG



The Invicta A40 table receiver.

THE Invicta A40 is a 3-valve (plus rectifier) AC superhet covering four wavebands. The SW ranges are 13.5 to 50 m (referred to as SW1 in this Service Sheet) and 50 to 200 m (referred to as SW2).

There is provision for an external speaker, and for a gramophone pick-up, the latter being switched by a fifth position on the waveband switch control.

The receiver is suitable for AC mains of 200-250 V, 40-100 C/S.

The A40 C console and A40 RG radio-gram have identical chassis.

Release date: May, 1940.

CIRCUIT DESCRIPTION

Aerial input via coupling coils **L1** (SW1), **L2** (SW2) and **L3** (MW and LW) to single tuned circuits **L4, C30** (SW1), **L5, C30** (SW2), **L6, C30** (MW) and **L7, C30** (LW). On MW, coupling is assisted by small condenser **C1** connected between **L3** and **L6.**

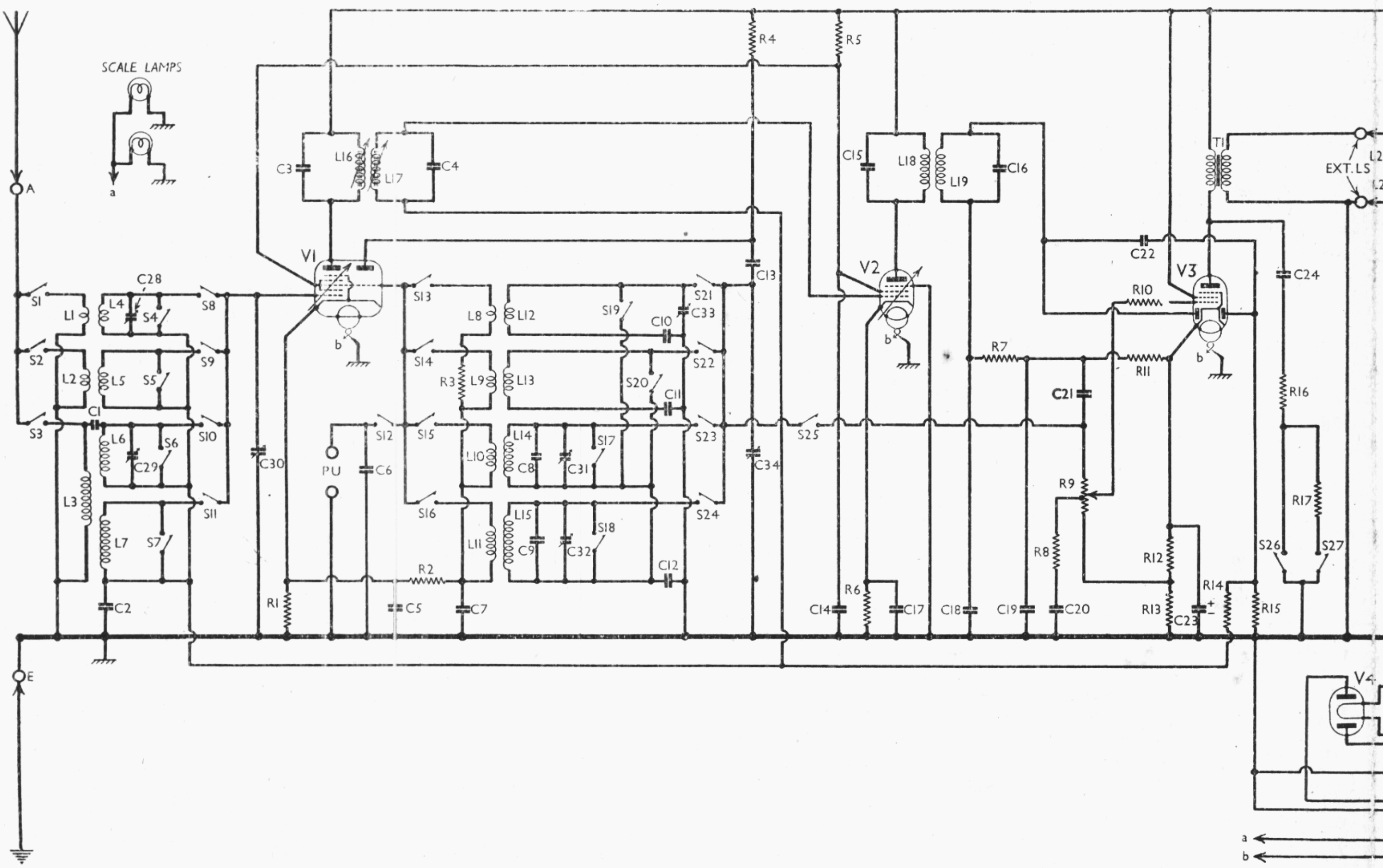
First valve **(V1, Mullard ECH3)** is a triode-heptode operating as frequency changer with internal coupling. Triode oscillator anode coils **L12** (SW1), **L13** (SW2), **L14** (MW) and **L15** (LW) are tuned by **C34;** parallel trimming by **C33** (SW1), **C8, C31** (MW) and **C9, C32** (LW); series tracking by **C10** (SW1), **C11** (SW2) and **C12** (MW and LW). Reaction by grid coils **L8** (SW1), **L9** (SW2), **L10** (MW) and **L11** (LW). The CG resistance **R2** and condenser **C7** are in the low-potential end of the reaction circuit.

Second valve **(V2, Mullard EF9)** is a variable-mu RF pentode operating as IF amplifier with tuned-primary, tuned-secondary transformer couplings **C3, L16, L17, C4** and **C15, L18, L19, C16.**

Intermediate frequency 465 KC/S.

Diode second detector is part of double diode pentode output valve **(V3, Mullard EBL1).** Audio frequency component in rectified output is developed across load resistance **R11** and passed via AF coupling condenser **C21,** manual volume control **R9** and grid stopper **R10** to CG of pentode section.

For operation with a gramophone pick-up, a pair of sockets is provided in the grid circuit of the triode section of **V1** via **S12.** When the switch control is turned to the "Gram" position, **S12** and **S25** close, and **V1** triode section becomes an AF amplifier with **R4** as its anode load resistance and **C13** as its output coupling condenser. Thus the pick-up output is handed on via **C13** and **S25** to the volume control, across which it is developed in amplified form.



A tone-compensating circuit **R8, C20** is connected between the centre-tap on **R9** and chassis.

IF filtering by **C18, R7** and **C19** in diode circuit. Three-position tone control in pentode anode circuit by **C24, R16, R17** and switches **S26, S27.** Either or both of the switches may be opened. Provision for connection of low impedance external speaker by sockets across secondary of the output transformer **T1.** As these sockets are used also to connect the internal speaker, the plugs of the latter are provided with a further socket each, so that both speakers may be operated together if desired.

Second diode of **V3,** fed from **L19** via **C22,** provides DC potential which is developed across load resistance **R15** and fed back through a decoupling circuit to FC and IF valves, giving automatic volume control. Delay voltage, together with GB for pentode section, is developed across resistances **R12** and **R13** in cathode lead to chassis.

HT current is supplied by full-wave rectifying valve **(V4, Mullard AZ1).** Smoothing by speaker field **L22** and dry electrolytic condensers **C25** and **C26.** A mains aerial connection is provided via **C27.** When this is not in use, the plug is inserted in a second earth socket, so that **C27** becomes a mains RF filter.

DISMANTLING THE SET

Removing Chassis.—Remove the four control knobs (recessed grub screws) from the front of the cabinet;

remove the four bolts (with metal and rubber washers) holding the chassis to the bottom of the cabinet;

withdraw the speaker speech coil plugs from the ext. LS sockets at the rear of the chassis.

The chassis can now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free the chassis entirely, unsolder from the top and bottom tags on the speaker connecting strip the two leads from chassis;

unsolder from the connecting panel on the speaker transformer a further three leads from chassis.

When replacing, connect the speaker leads as follows:

red to top tag on speaker connecting strip;

black (together with black lead from speaker transformer) to bottom tag;

brown to top left-hand tag on transformer connecting panel;

yellow to top right-hand tag on transformer panel;

green to bottom right-hand tag on transformer panel.

Note that a shaped rubber washer is fitted to each chassis fixing bolt, between the chassis and the floor of the cabinet, and that a metal washer and a flat rubber washer are fitted under the head of each bolt.

Removing Speaker.—Unsolder the black and red leads from the top and bottom tags on the connecting strip on the speaker;

withdraw the speech coil plugs from the ext. LS sockets at the rear of the chassis;

remove the four hexagon nuts holding the speaker to the sub-baffle.

When replacing, the connecting strip should be on the right.

Removing Speaker Transformer.—Unsolder the four connecting leads from the panel on the transformer;

remove the two hexagon nuts holding the transformer to the sub-baffle.

When replacing, the transformer should be on the right of the speaker;

that side of the connecting panel which carries three tags (middle one blank) should be on the right of the transformer;

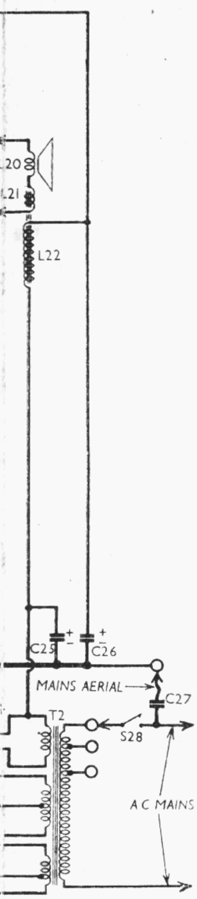
three leads from chassis should be connected as previously indicated;

a fourth (short, black) lead should be connected between the bottom left-hand tag on the transformer panel and the bottom tag on the speaker connecting strip.

COMPONENTS AND VALUES

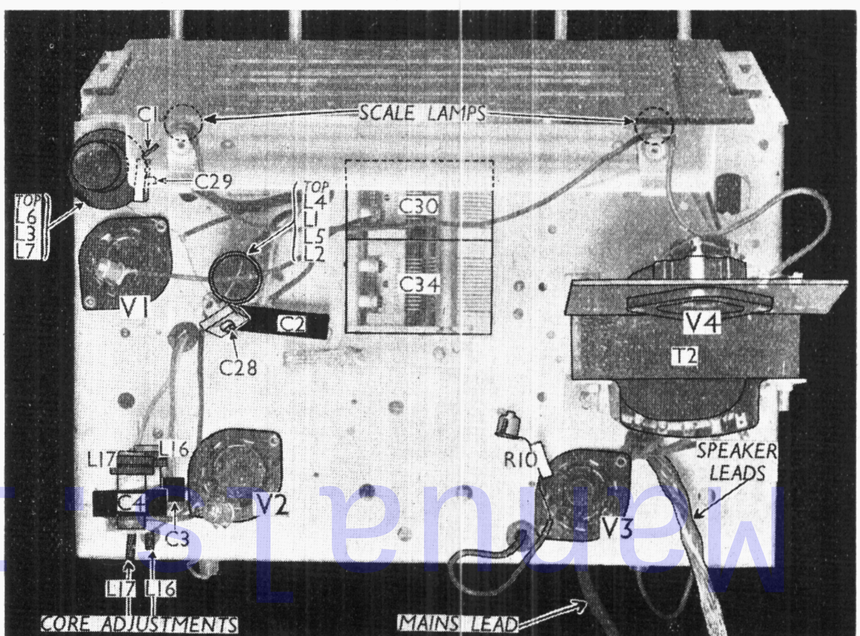
	CONDENSERS	Values (μF)
C1	Part of MW aerial coupling	0.000006
C2	V1 heptode CG decoupling	0.1
C3	1st IF transformer fixed tuning condensers	0.0001
C4	1st IF transformer fixed tuning condensers ...	0.0001
C5	V1 cathode by-pass ...	0.1
C6	Gram PU shunt	0.005
C7	V1 osc. CG condenser ...	0.00015
C8	Osc. circuit MW fixed trimmer	0.00002
C9	Osc. circuit LW fixed trimmer	0.00026
C10	Osc. circuit SW1 tracker...	0.005
C11	Osc. circuit SW2 tracker...	0.0013
C12	Osc. circuit MW and LW tracker	0.000657
C13	V1 osc. anode coupling ...	0.005
C14	V1, V2 SG's decoupling...	0.1
C15	2nd IF transformer fixed tuning condensers	0.0001
C16	2nd IF transformer fixed tuning condensers ...	0.0001
C17	V2 cathode by-pass ...	0.1
C18	IF by-pass condensers ...	0.00015
C19	IF by-pass condensers ...	0.00015
C20	Part of tone compensator	0.005
C21	AF coupling to V3 pentode	0.005
C22	Coupling to V3 AVC diode	0.00002
C23*	V3 cathode by-pass ...	20.0
C24	Part of tone control ...	0.05
C25*	HT smoothing condensers	8.0
C26*	HT smoothing condensers	8.0
C27	Mains aerial coupling ...	0.001
C28‡	Aerial circuit SW1 trimmer	0.00003
C29‡	Aerial circuit MW trimmer	0.00003
C30†	Aerial circuit tuning ...	0.000554
C31‡	Osc. circuit MW trimmer	0.00003
C32‡	Osc. circuit LW trimmer	0.00003
C33‡	Osc. circuit SW1 trimmer	—
C34†	Oscillator circuit tuning...	0.000554

* Electrolytic. † Variable. ‡ Pre-set.



Left: Circuit diagram of the Invicta A40 range, which applies to table, console and radiogram models. Pick-up switching is incorporated, the triode section of V1 being used as an AF amplifier on gram. There is provision for an external speaker, and for the use of the mains as an aerial.

Right: Plan view of the chassis. In some models T2 may be mounted through the chassis, and V4 holder may be in a different position. C1 is a small wire-wound condenser.



RESISTANCES		Values (ohms)
R1	V1 heptode fixed GB resistance	150
R2	V1 osc. CG resistance	18,000
R3	Osc. SW1 reaction stabiliser	47
R4	V1 osc. anode HT feed	18,000
R5	V1, V2 SG's HT feed	47,000
R6	V2 fixed GB resistance	330
R7	IF stopper	47,000
R8	Part of tone compensator	47,000
R9	Manual volume control	1,000,000*
R10	V3 pentode CG stopper	100,000
R11	V3 signal diode load	470,000
R12	V3 pent. GB and AVC delay potential divider resistances	150
R13		330
R14	AVC line decoupling	1,000,000
R15	V3 AVC diode load	1,000,000
R16	Parts of tone control filter	3,300
R17		10,000

* Centre-tapped.

OTHER COMPONENTS		Approx. Values (ohms)
L1	Aerial SW1 coupling coil	0·3
L2	Aerial SW2 coupling coil	0·8
L3	Aerial MW and LW coupling	65·0
L4	Aerial SW1 tuning coil	Very low
L5	Aerial SW2 tuning coil	0·3
L6	Aerial MW tuning coil	3·6
L7	Aerial LW tuning coil	13·3
L8	Oscillator SW1 reaction	34·0
L9	Oscillator SW2 reaction	6·6
L10	Oscillator MW reaction	10·0
L11	Oscillator LW reaction	12·0
L12	Osc. circuit SW1 tuning coil	Very low
L13	Osc. circuit SW2 tuning coil	1·0
L14	Osc. circuit MW tuning coil	2·0
L15	Osc. circuit LW tuning coil	3·0
L16	1st IF trans. Pri.	6·5
L17	1st IF trans. Sec.	6·5
L18	2nd IF trans. Pri.	9·0
L19	2nd IF trans. Sec.	9·0
L20	Speaker speech coil	1·8
L21	Hum neutralising coil	0·15
L22	Speaker field coil	2,000·0
T1	Output trans. Pri.	270·0
	Output trans. Sec.	0·15
T2	Mains trans. Pri., total	24·0
	Heater sec., total	0·15
	Rect. heat. sec.	0·1
	HT sec., total	700·0
S1-S11, S13-S24	Waveband switches	—
S12, S25	Gram pick-up switches	—
S26, S27	Tone control switches	—
S28	Mains switch, ganged R9	—

VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating on mains of 233 V, using the 216-235 V tapping on the mains transformer. The receiver was tuned to the lowest wavelength on the medium wave band, and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 400 V scale of a model 7 Universal Avometer, chassis being negative.

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 ECH3	274	2.5	84	2.8
	Oscillator			
	135	5.6		
V2 EF9	274	4.5	84	1.4
V3 EBL1	262	37.0	274	4.8
V4 AZ1	380†	—	—	—

† Each anode, AC.

GENERAL NOTES

Switches.—**S1-S25** are the waveband and gramophone pick-up switches, in two ganged rotary units beneath the chassis. These are indicated in our under-chassis view, and shown in detail in the diagrams in col. 3, where they are drawn as seen looking from the rear of the underside of the chassis.

The table below gives the switch positions for the five control settings, starting from fully anti-clockwise. A dash indicates open, and **C**, closed.

S26, S27 are the tone control switches, in a 3-position rotary unit beneath the chassis. The tags of these switches are indicated in our under-chassis view, the chassis being one connection of each switch. In the fully anti-clockwise position of the control, **S26** is closed; in the central position, **S27** is closed, while in the fully clockwise position both switches are open.

S28 is the QMB mains switch, ganged with the volume control **R9.**

Coils.—**L1, L2, L4, L5; L3, L6, L7** and the first IF transformer **L16, L17** are in three unscreened tubular units on the chassis deck. **L8, L12; L9, L13; L10, L14** and **L11, L15** are in four unscreened tubular units beneath the chassis, mounted around the switch units. The positions of these cannot be clearly seen in the under-chassis view, so a separate diagram is given in col. 3, looking from the rear of the underside of the chassis. The last two of these units have trimmers mounted on them.

The second IF transformer **L18, L19,** is also beneath the chassis, and is not screened.

Note that the coils in the first IF transformer have adjustable iron cores, indicated in the plan chassis view, whereas the second IF transformer is air-cored and fixed tuned.

Scale Lamps.—These are two Mazda MES types, rated at 6.2 V, 0.3 A. They are run from a 4 V tapping on **T2** heater secondary.

External Speaker.—The speech and hum coils of the internal speaker, in series, plug into two sockets at the rear of the receiver chassis, socketed plugs being used for the connections. A low impedance (2 O) external speaker may be plugged into the socketed plugs, or direct into the chassis sockets if the internal speaker is not required.

Switch Table

Switch	Gram	SW1	SW2	MW	LW
S1	—	C	—	—	—
S2	—	—	C	—	—
S3	—	—	—	C	C
S4	C	—	—	—	—
S5	—	C	—	—	—
S6	—	—	C	—	—
S7	—	—	—	C	—
S8	—	C	—	—	—
S9	—	—	C	—	—
S10	—	—	—	C	—
S11	—	—	—	—	C
S12	C	—	—	—	—
S13	—	C	—	—	—
S14	—	—	C	—	—
S15	—	—	—	C	—
S16	—	—	—	—	C
S17	—	—	C	—	—
S18	—	—	—	C	—
S19	C	—	—	—	—
S20	—	C	—	—	—
S21	—	C	—	—	—
S22	—	—	C	—	—
S23	—	—	—	C	—
S24	—	—	—	—	C
S25	C	—	—	—	—

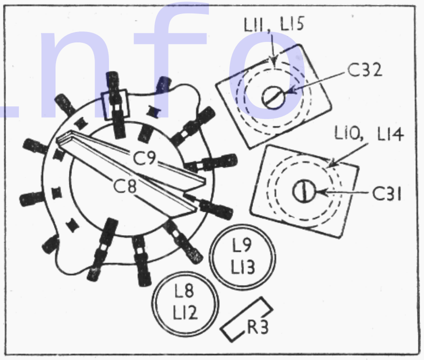


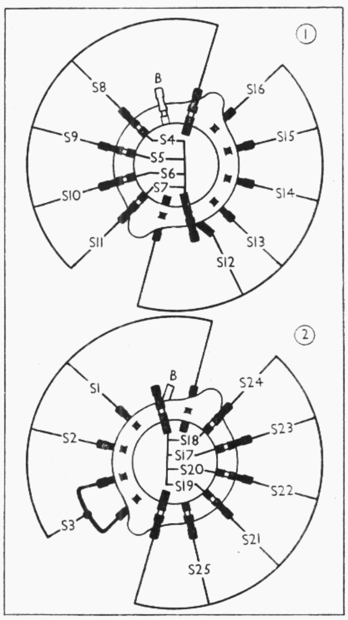
Diagram of the coil assembly beneath the chassis, which cannot be clearly seen in the under-chassis view. It is drawn looking from the rear of the underside of the chassis.

Condensers C25, C26.—These are two 8 μF (550 peak volts) dry electrolytics, in a single carton beneath the chassis, having a common negative (black) lead. The red lead to a bearer tag on a paxolin plate on the underside of the chassis is the positive of **C25,** while the red lead to **V3** holder is the positive of **C26.**

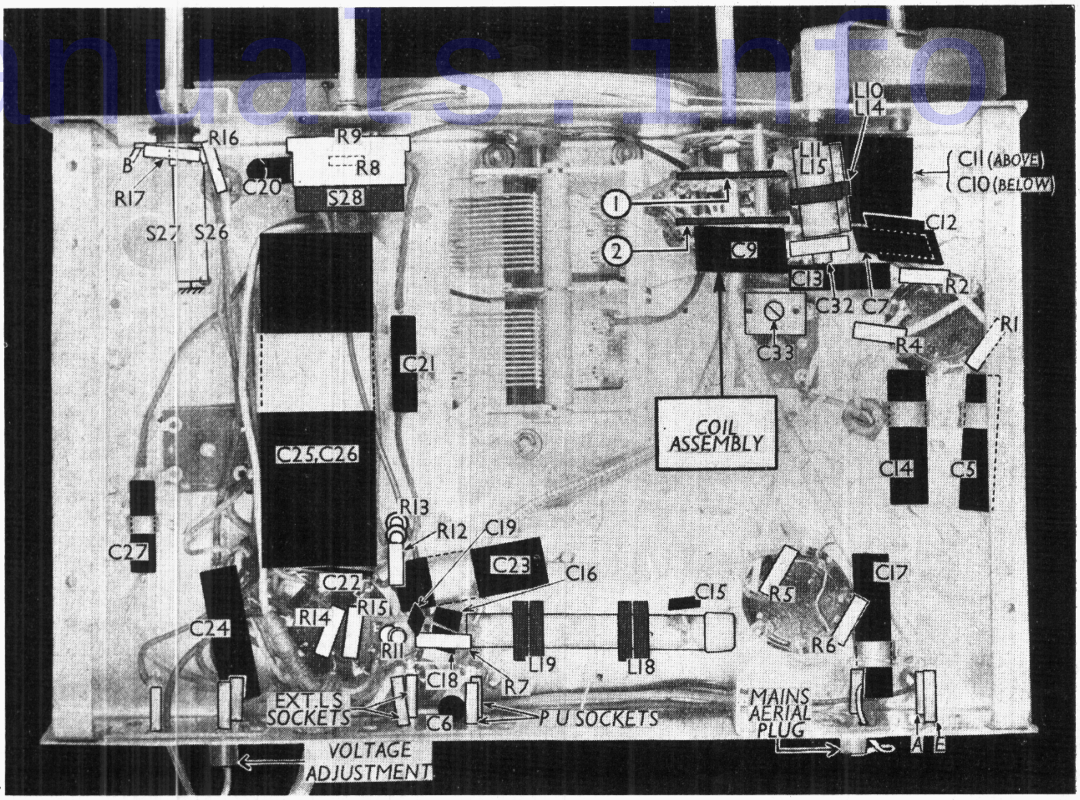
Condenser C1.—This is a small wire-wound type, at the side of the **L3, L6, L7** coil unit.

Pre-set Condensers.—There are two pre-set condensers, one on each aerial coil unit, on the chassis deck, and three beneath the chassis. One of these is on the **L10, L14** coil unit, one on the **L11, L15** unit, and one **(C33)** on a small paxolin panel underneath the chassis deck.

Chassis Divergencies.—**C6** and **C33** are not shown in the makers' diagram, while **C8** and **C9** are not shown separate from



Diagrams of the two switch units, as seen from the rear of the underside of the chassis.



Under-chassis view. Certain of the coils and other components are shown in a diagram in col. 3 opposite, and the switch diagrams are in the same column. The tags of the tone control switches **S26**, **S27** are indicated, one side of each switch going to chassis.

C31 and **C32**. **R2** may be 47,000 O, and **R4** may be 22,000 O. **R3** is shown by the makers as being between **S13** and the top of **L8**. In some cases the mains transformer will be of the drop-through type, mounted through the chassis deck. In others it will be mounted on the chassis deck (as in our case), but will not have the **V4** holder mounted above it.

CIRCUIT ALIGNMENT

IF Stages.—Only the first IF transformer will need adjustment, the second being fixed-tuned at the works. Connect signal generator, via a 0.1 μF condenser, to control grid (top cap) of **V1** and chassis. Connect a 100,000 O resistor between control grid and chassis. Switch set to LW, and turn gang to maximum.

Feed in a 465 KC/S signal, and adjust cores of **L16, L17** for maximum output. Remove the condenser and resistor.

RF and Oscillator Stages.—With gang at maximum, pointer should cover the right-hand ends of the clear sections of the scales. Connect signal generator, via a suitable dummy aerial, to **A** and **E** sockets.

MW.—Switch set to MW, tune to 200 m on scale, feed in a 200 m (1,500 KC/S) signal, and adjust **C31**, then **C29**, for maximum output. Check at 550 m.

LW.—Switch set to LW, tune to 1,200 m on scale, feed in a 1,200 m (250 KC/S) signal, and adjust **C32** for maximum output. Check at 2,000 m.

SW2.—There are no adjustments on this band.

SW1.—Switch set to SW1, feed in a 14 m (21.4 MC/S) signal, and tune it in accurately. Adjust **C33**, then **C28**, for maximum output. Check at 50 m.

Faults in Iron-Cored Coils

LAST week some of the faults liable to be encountered in air and iron dust cored coils were considered, and we now come to the laminated iron core type of coil and transformer. For the most part, the faults in this type of component are similar to those in RF coils, but since the windings are often of heavier gauge wires, troubles due to mechanical breakages are not very common.

On the other hand, most components in this class when working are carrying certain direct currents, which sometimes results in corrosion of soldered joints. The heating up of the windings (not necessarily due to overloads) often causes strain on the windings, chafing between turns in the windings, or between windings and the former on which they are wound. The results are shorted turns, leakages and intermittent or complete breakages.

Voltage surges are commonly encountered in windings which may or may not be already carrying DC, and these, again, may cause breakdown, particularly if adjacent windings happen to have high differences in potential between them.

Troubles of this nature are fortunately becoming quite rare in modern receivers, and generally one does not find many cases of choke or transformer breakdown under normal running conditions. Usually breakdown or damage is due to faults in associated components, such as fixed condensers, which cause abnormally heavy currents to flow through other components.

Buzzing or hum due to loose core laminations used to be quite a common complaint, but now it is not often encountered, unless the component is being overloaded owing to a fault in some other part of the circuit.

External faults, due to the leads from the transformer or choke rubbing against the core or sharp parts of the chassis, and eventually leaking or shorting, still crop up regularly; for this, of course, the set-maker must take the blame.

Heater windings of mains transformers are wound with heavy gauge wire, and often the leads form continuations of the windings. In this case trouble has sometimes occurred because these wires have not been strongly soldered, and break away from their connections. Heavy gauge flexibles would be an improvement here.

The field winding of an energised speaker is, of course, subject to the same types of fault as in iron-cored choke, but these windings rarely give trouble except from outside causes. Speech coils in modern loudspeakers seldom break down, since they are usually low impedance types, wound with a few turns of comparatively thick wire.

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